

1 We claim:

1 1. A data storage device comprising a computer useable medium having  
2 computer readable program code disposed therein for recording information on a data  
3 storage medium, the computer readable program code comprising a series of computer  
4 readable program steps to effect:

5 receiving a first command to record first information on said data storage  
6 medium;

7 receiving said first information;

8 moving said data storage medium in a first direction;

9 recording said first information beginning at a first time on said moving data  
10 storage medium;

11 receiving a first deferred conditional write tape mark command; and

12 setting at a second time a first deferred conditional tape mark indicator.

1 2. The data storage device of claim 1, wherein said first information  
2 comprises:

3 a first header label group;

4 first data; and

5 a first trailer label group.

1 3. The data storage device of claim 2, wherein said computer readable  
2 program code further comprises a series of computer readable program steps to effect:

3 writing said first header label group to said moving data storage medium;

4 writing a first tape mark adjacent said first header label group;

5 writing said first data adjacent said first tape mark;

6 writing a second tape mark adjacent said first data;  
7 writing said first trailer label group adjacent said second tape mark; and  
8 writing a third tape mark adjacent said first trailer label group.

1 4. The data storage device of claim 1, wherein said computer readable  
2 program code further comprises a series of computer readable program steps to effect:  
3 specifying a deferred conditional tape mark indicator time interval; and  
4 maintaining said first deferred conditional tape mark indicator during said  
5 deferred conditional tape mark indicator time interval.

1 5. The data storage device of claim 4, wherein said deferred conditional tape  
2 mark indicator time interval is between about 5 seconds and about 20 seconds.

1 6. The data storage device of claim 5, wherein said deferred conditional tape  
2 mark indicator time interval is about 10 seconds.

1 7. The data storage device of claim 4, wherein said computer readable  
2 program code further comprises a series of computer readable program steps to effect:  
3 receiving a second command at a third time to record second information on said  
4 data storage medium, wherein the time interval between said second time and said third  
5 time is less than said deferred conditional tape mark indicator time interval;

6 receiving said second information;  
7 resetting said first conditional deferred tape mark indicator;  
8 moving said data storage medium in a first direction;  
9 recording said second information on said moving data storage medium;  
10 receiving a second deferred conditional write tape mark command;  
11 setting a second deferred conditional tape mark indicator at a fourth time;

12 moving said data storage medium only in said first direction during the time  
13 interval between said first time and said fourth time.

1 8. The data storage device of claim 7, wherein said second information  
2 comprises:

3 a second header label group;  
4 second data; and  
5 a second trailer label group.

1 9. The data storage device of claim 8, wherein said computer readable  
2 program code further comprises a series of computer readable program steps to effect:

3 writing said second header label group to said moving data storage medium  
4 adjacent said third tape mark;

5 writing a fourth tape mark to said moving data storage medium adjacent said  
6 second header label group;

7 writing said second data to said moving data storage medium adjacent said fourth  
8 tape mark;

9 writing a fifth tape mark to said moving data storage medium adjacent said  
10 second data;

11 writing said second trailer label group to said moving data storage medium  
12 adjacent said fifth tape mark; and

13 writing a sixth tape mark to said moving data storage medium adjacent said  
14 second trailer label group.

1 10. The data storage device of claim 3, wherein said computer readable  
2 program code further comprises a series of computer readable program steps to effect:

receiving a second command, wherein said second command causes motion of said data storage medium in a second direction or causes synchronization of said data storage medium;

resetting said first deferred conditional tape mark indicator;

disposing a double tape mark on said data storage medium by writing a fourth tape mark adjacent said third tape mark;

moving said data storage medium in a second direction;

positioning said read/write head between said third tape mark and said fourth tape mark.

11. The data storage device of claim 10, wherein said computer readable program code further comprises a series of computer readable program steps to effect:

determining if said double tape mark was successfully written to said data storage medium;

determining if said read/write head was successfully positioned between said third tape mark and said fourth tape mark.

12. The data storage device of claim 11, wherein said double tape mark was not successfully written to said data storage medium, and wherein said read/write head was successfully repositioned between said third tape mark and said fourth tape mark, wherein said computer readable program code further comprises a series of computer readable program steps to effect indicating an UNWRITTEN DEFERRED TAPE MARK error message.

13. The data storage device of claim 11, wherein said double tape mark was successfully written to said data storage medium, and wherein said read/write head was

not successfully repositioned between said third tape mark and said fourth tape mark,  
wherein said computer readable program code further comprises a series of computer  
readable program steps to effect indicating a DATA CHECK/LOST POSITIONING error  
message.

14. The data storage device of claim 11, wherein said double tape mark was  
not successfully written to said data storage medium, and wherein said read/write head  
was not successfully repositioned between said third tape mark and said fourth tape mark,  
wherein said computer readable program code further comprises a series of computer  
readable program steps to effect:

indicating a DATA CHECK/LOST POSITIONING error message; and  
indicating an UNWRITTEN DEFERRED TAPE MARK error message.

15. A data storage and retrieval system comprising a data storage device, a  
data storage medium removeably disposed in said data storage device, and a host  
computer which provides first information to said data storage device, wherein said data  
storage device comprises a computer useable medium having computer readable program  
code disposed therein for recording information on a data storage medium storage  
medium, the computer readable program code comprising a series of computer readable  
program steps to effect:

receiving a first command to record first information on said data storage  
medium;

receiving said first information;

moving said data storage medium in a first direction;

12 recording said first information on said moving data storage medium beginning at  
13 a first time;

14 receiving a first deferred conditional write tape mark command; and

15 setting a first deferred conditional tape mark indicator at a second time.

1 16. The data storage and retrieval system of claim 15, wherein said first  
2 information comprises:

3 a first header label group;

4 first data; and

5 a first trailer label group.

1 17. The data storage and retrieval system of claim 16, wherein said computer  
2 readable program code further comprises a series of computer readable program steps to  
3 effect:

4 writing said first header label group to said moving data storage medium;

5 writing a first tape mark adjacent said first header label group;

6 writing said first data adjacent said first tape mark;

7 writing a second tape mark adjacent said first data;

8 writing said first trailer label group adjacent said second tape mark; and

9 writing a third tape mark adjacent said first trailer label group.

1 18. The data storage and retrieval system of claim 15, wherein said computer  
2 readable program code further comprises a series of computer readable program steps to  
3 effect:

4 specifying a deferred conditional tape mark indicator time interval; and

5 maintaining said first deferred conditional tape mark indicator during said  
6 deferred conditional tape mark indicator time interval.

1 19. The data storage and retrieval system of claim 18, wherein said deferred  
2 conditional tape mark indicator time interval is between about 5 seconds and about 20  
3 seconds.

1 20. The data storage and retrieval system of claim 19, wherein said deferred  
2 conditional tape mark indicator time interval is about 10 seconds.

1 21. The data storage and retrieval system of claim 15, wherein said computer  
2 readable program code further comprises a series of computer readable program steps to  
3 effect:

4 receiving a second command at a third time to record second information on said  
5 data storage medium, wherein the time interval between said second time and said third  
6 time is less than said deferred conditional tape mark indicator time interval;

7 receiving said second information from said host computer;

8 resetting said first conditional deferred tape mark indicator;

9 moving said data storage medium in said second direction;

10 recording said second information on said moving data storage medium;

11 receiving a second deferred conditional write tape mark command;

12 setting a second deferred conditional tape mark indicator at a fourth time;

13 wherein said data storage medium is moved only in said first direction during the  
14 time interval between said first time and said fourth time.

1 22. The data storage and retrieval system of claim 21, wherein said second  
2 information comprises:

059464650

3 a second header label group;  
4 second data; and  
5 a second trailer label group.

1 23. The data storage and retrieval system of claim 22, wherein said computer  
2 readable program code further comprises a series of computer readable program steps to  
3 effect:

4 writing said second header label group to said moving data storage medium  
5 adjacent said third tape mark;

6 writing a fourth tape mark to said moving data storage medium adjacent said  
7 second header label group;

8 writing said second data to said moving data storage medium adjacent said fourth  
9 tape mark;

10 writing a fifth tape mark to said moving data storage medium adjacent said  
11 second data;

12 writing said second trailer label group to said moving data storage medium  
13 adjacent said fifth tape mark; and

14 writing a sixth tape mark to said moving data storage medium adjacent said  
15 second trailer label group.

1 24. The data storage and retrieval system of claim 15, wherein said computer  
2 readable program code further comprises a series of computer readable program steps to  
3 effect:



4 receiving a second command, wherein said second command causes motion of  
5 said data storage medium in a second direction or causes synchronization of said data  
6 storage medium;

7 resetting said first deferred conditional tape mark indicator;

8 disposing a double tape mark on said data storage medium by writing a fourth  
9 tape mark adjacent said third tape mark;

10 moving said data storage medium in a second direction;

11 positioning said read/write head between said third tape mark and said fourth tape  
12 mark.

1 25. The data storage and retrieval system of claim 24, wherein said computer  
2 readable program code further comprises a series of computer readable program steps to  
3 effect:

4 determining if said double tape mark was successfully written to said data storage  
5 medium;

6 determining if said read/write head was successfully positioned between said third  
7 tape mark and said fourth tape mark.

1 26. The data storage and retrieval system of claim 25, wherein said double  
2 tape mark was not successfully written to said data storage medium, and wherein said  
3 read/write head was successfully repositioned between said third tape mark and said  
4 fourth tape mark, wherein said computer readable program code further comprises a  
5 series of computer readable program steps to effect indicating an UNWRITTEN  
6 DEFERRED TAPE MARK error message.

1           27.     The data storage and retrieval system of claim 25, wherein said double  
2     tape mark was successfully written to said data storage medium, and wherein said  
3     read/write head was not successfully repositioned between said third tape mark and said  
4     fourth tape mark, wherein said computer readable program code further comprises a  
5     series of computer readable program steps to effect indicating a DATA CHECK/LOST  
6     POSITIONING error message.

1           28.     The data storage and retrieval system of claim 25, wherein said double  
2     tape mark was not successfully written to said data storage medium, and wherein said  
3     read/write head was not successfully repositioned between said third tape mark and said  
4     fourth tape mark, wherein said computer readable program code further comprises a  
5     series of computer readable program steps to effect:

6                 indicating a DATA CHECK/LOST POSITIONING error message; and

7                 indicating an UNWRITTEN DEFERRED TAPE MARK error message.

1           29.     A computer program product usable with a programmable computer  
2     processor having computer readable program code embodied therein for disposing  
3     information on a data storage medium using a data storage device comprising a  
4     read/write head, comprising:

5                 computer readable program code which causes said programmable computer  
6     processor to receive a first command to record first information on said data storage  
7     medium;

8                 computer readable program code which causes said programmable computer  
9     processor to receive said first information;

10 computer readable program code which causes said programmable computer  
11 processor to move said data storage medium in a first direction;  
12 computer readable program code which causes said programmable computer  
13 processor to record said first information on said moving data storage medium beginning  
14 at a first time;  
15 computer readable program code which causes said programmable computer  
16 processor to receive a first deferred conditional write tape mark command; and  
17 computer readable program code which causes said programmable computer  
18 processor to set a first deferred conditional tape mark indicator at a second time.

1 30. The computer program product of claim 29, wherein said first information  
2 comprises:

3 a first header label group;  
4 first data; and  
5 a first trailer label group.

1 31. The computer program product of claim 30, further comprising:  
2 computer readable program code which causes said programmable computer  
3 processor to write said first header label group to said moving data storage medium;  
4 computer readable program code which causes said programmable computer  
5 processor to write a first tape mark adjacent said first header label group;  
6 computer readable program code which causes said programmable computer  
7 processor to write said first data adjacent said first tape mark;  
8 computer readable program code which causes said programmable computer  
9 processor to write a second tape mark adjacent said first data;

10 computer readable program code which causes said programmable computer  
11 processor to write said first trailer label group adjacent said second tape mark; and  
12 computer readable program code which causes said programmable computer  
13 processor to write a third tape mark adjacent said first trailer label group.

1 32. The computer program product of claim 29, further comprising:  
2 computer readable program code which causes said programmable computer  
3 processor to specify a deferred conditional tape mark indicator time interval; and  
4 computer readable program code which causes said programmable computer  
5 processor to maintain said first deferred conditional tape mark indicator during said  
6 deferred conditional tape mark indicator time interval.

1 33. The computer program product of claim 32, wherein said deferred  
2 conditional tape mark indicator time interval is between about 5 seconds and about 20  
3 seconds.

1 34. The computer program product of claim 33, wherein said deferred  
2 conditional tape mark indicator time interval is about 10 seconds.

1 35. The computer program product of claim 32, further comprising:  
2 computer readable program code which causes said programmable computer  
3 processor to receive a second command at a third time to record second information on  
4 said data storage medium, wherein the time interval between said second time and said  
5 third time is less than said deferred conditional tape mark indicator time interval;  
6 computer readable program code which causes said programmable computer  
7 processor to receive said second information;

8 computer readable program code which causes said programmable computer  
9 processor to reset said first conditional deferred tape mark indicator;  
10 computer readable program code which causes said programmable computer  
11 processor to move said data storage medium in said first direction;  
12 computer readable program code which causes said programmable computer  
13 processor to record said second information on said moving data storage medium;  
14 computer readable program code which causes said programmable computer  
15 processor to receive a second deferred conditional write tape mark command;  
16 computer readable program code which causes said programmable computer  
17 processor to set a second deferred conditional tape mark indicator at a fourth time;  
18 computer readable program code which causes said programmable computer  
19 processor to move said data storage medium only in said first direction during the time  
20 interval between said first time and said fourth time.

1 36. The computer program product of claim 35, wherein said second  
2 information comprises:

3 a second header label group;  
4 second data; and  
5 a second trailer label group.

1 37. The computer program product of claim 36, further comprising:  
2 computer readable program code which causes said programmable computer  
3 processor to write said second header label group to said moving data storage medium  
4 adjacent said third tape mark;

5 computer readable program code which causes said programmable computer  
6 processor to write a fourth tape mark to said moving data storage medium adjacent said  
7 second header label group;

8 computer readable program code which causes said programmable computer  
9 processor to write said second data to said moving data storage medium adjacent said  
10 fourth tape mark;

11 computer readable program code which causes said programmable computer  
12 processor to write a fifth tape mark to said moving data storage medium adjacent said  
13 second data;

14 computer readable program code which causes said programmable computer  
15 processor to write said second trailer label group to said moving data storage medium  
16 adjacent said fifth tape mark; and

17 computer readable program code which causes said programmable computer  
18 processor to write a sixth tape mark to said moving data storage medium adjacent said  
19 second trailer label group.

1 38. The computer program product of claim 35, further comprising:

2 computer readable program code which causes said programmable computer  
3 processor to receive a second command, wherein said second command causes motion of  
4 said data storage medium in a second direction or causes synchronization of said data  
5 storage medium;

6 computer readable program code which causes said programmable computer  
7 processor to reset said first deferred conditional tape mark indicator;

TUC9 20010053 US2B

8 computer readable program code which causes said programmable computer  
9 processor to dispose a double tape mark on said data storage medium by writing a fourth  
10 tape mark adjacent said third tape mark;

11 computer readable program code which causes said programmable computer  
12 processor to move said data storage medium in a second direction;

13 computer readable program code which causes said programmable computer  
14 processor to position said read/write head between said third tape mark and said fourth  
15 tape mark.

1 39. The computer program product of claim 38, further comprising:

2 computer readable program code which causes said programmable computer  
3 processor to determine if said double tape mark was successfully written to said data  
4 storage medium; and

5 computer readable program code which causes said programmable computer  
6 processor to determine if said read/write head was successfully positioned between said  
7 third tape mark and said fourth tape mark.

1 40. The computer program product of claim 39, wherein said double tape  
2 mark was not successfully written to said data storage medium, and wherein said  
3 read/write head was successfully repositioned between said third tape mark and said  
4 fourth tape mark, further comprising computer readable program code which causes said  
5 programmable computer processor to a series of computer readable program steps to  
6 indicate an UNWRITTEN DEFERRED TAPE MARK error message.

1 41. The computer program product of claim 39, wherein said double tape  
2 mark was successfully written to said data storage medium, and wherein said read/write

3 head was not successfully repositioned between said third tape mark and said fourth tape  
 4 mark, further comprising computer readable program code which causes said  
 5 programmable computer processor to a series of computer readable program steps to  
 6 indicate a DATA CHECK/LOST POSITIONING error message.

1 42. The computer program product of claim 39, wherein said double tape  
 2 mark was not successfully written to said data storage medium, and wherein said  
 3 read/write head was not successfully repositioned between said third tape mark and said  
 4 fourth tape mark, further comprising:

5 computer readable program code which causes said programmable computer  
 6 processor to indicate a DATA CHECK/LOST POSITIONING error message; and

7 computer readable program code which causes said programmable computer  
 8 processor to indicate an UNWRITTEN DEFERRED TAPE MARK error message.